

CLAIMS

1. A high tenacity nonwoven fabric wherein the nonwoven fabric is a laminated fabric formed by integrating, through compressive bonding, three stacked  
5 layers comprising an upper and a lower thermoplastic synthetic filamentary fiber layer having a fiber diameter from 7  $\mu\text{m}$  or more to 20  $\mu\text{m}$ , and at least one intermediate layer composed of at least one thermoplastic synthetic  
10 fine fiber layer having a fiber diameter of 5  $\mu\text{m}$  or less, the laminated nonwoven fabric having an intimately mixed structure layer in which a portion of the fine fibers forming the intermediate layer is intruded into at least one face side of the filamentary fiber layers with an  
15 intrusion index of 0.36 or more to bond, surround or interlace the filamentary fibers, a basis of weight of from 10 g or more to 250 g/m<sup>2</sup>, and a bulk density of 0.20 g/cm<sup>3</sup> or more.

2. The high tenacity nonwoven fabric according to claim 1, wherein the fine fibers have a fiber diameter of  
20 3  $\mu\text{m}$  or less.

3. The high tenacity nonwoven fabric according to any one of claims 1 to 2, wherein the nonwoven fabric has a structure in which a plurality of fine fibers gathered in a layer form are intruded into the filamentary fiber  
25 layers to bond, surround or interlace the filamentary fibers.

4. The high tenacity nonwoven fabric according to any one of claims 1 to 3, wherein the nonwoven fabric has a content of the fine fibers of 50% by weight or less.

30 5. The high tenacity nonwoven fabric according to any one of claims 1 to 4, wherein the thermoplastic resin forming the continuous filamentary fibers is mainly composed of a polyester or a copolymer of a polyester, or a mixture of the polyester and the copolymer, and the  
35 thermoplastic resin forming the fine fibers is mainly composed of a polyester or a copolymer of a polyester, or

a mixture of the polyester and the copolymer.

6. The high tenacity nonwoven fabric according to claim 5, wherein the polyester resin forming the fine fibers has a solution viscosity  $\eta_{sp}/c$  from 0.2 to 0.8.

5           7. The high tenacity nonwoven fabric according to any one of claims 1 to 4, wherein the thermoplastic resin forming the continuous filamentary fibers is mainly composed of a polyamide resin or a copolymer of a polyamide resin, or a mixture of the polyamide resin and  
10 the copolymer, and the thermoplastic resin forming the fine fibers is mainly composed of a polyamide resin or a copolymer of a polyamide resin, or a mixture of the polyamide resin and the copolymer.

15           8. The high tenacity nonwoven fabric according to claim 7, wherein the polyamide forming the melt-blown fine fibers has a solution relative viscosity  $\eta_{rel}$  from 1.8 to 2.7.

          9. A method of producing a high tenacity nonwoven fabric, comprising the steps of:

20                   spinning filamentary fibers in at least one layer out of a thermoplastic synthetic resin on a conveyor,

                  melt blowing fine fibers having a crystallinity from 15% or more to 40% or less out of a  
25 thermoplastic synthetic resin in at least one layer, on the filamentary fibers,

                  placing filamentary fibers formed out of a thermoplastic synthetic resin in at least one layer, on the fine fiber layer, and

30                   integrating the stacked fiber layers by thermocompressive bonding with emboss rolls or flat rolls at thermocompressive bonding temperature from 10 to 80°C below the melting point of the filamentary fibers at a line pressure from 100 to 1,000 N/cm.

35           10. The method of producing a high tenacity nonwoven fabric according to claim 9, wherein filamentary

fibers are spun out of a polyester resin in at least one layer, on a conveyor, fine fibers having a crystallinity from 15% or more to 40% or less are blown out of a polyester resin having a solution viscosity  $\eta_{sp}/c$  from 0.2 to 0.8 by melt blowing in at least one layer, on the filamentary fibers, and filamentary fibers formed out of a polyester resin are placed on the fine fiber layer, in at least one layer.

11. The method of producing a high tenacity nonwoven fabric according to claim 9, wherein filamentary fibers are spun out of a polyamide resin in at least one layer, on a conveyor, fine fibers are blown out of a polyamide resin having a relative solution viscosity  $\eta_{rel}$  from 1.8 to 2.7 by melt blowing in at least one layer, on the filamentary fibers, and filamentary fibers formed out of a polyamide resin are placed on the fine fiber layer, in at least one layer.